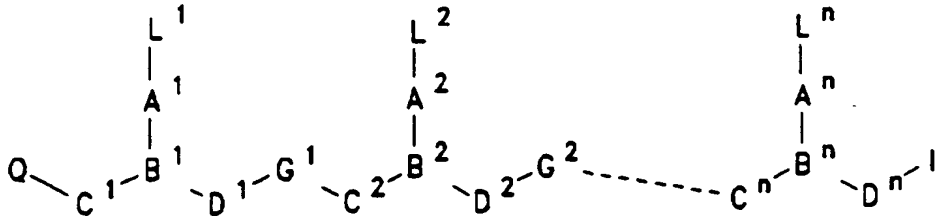
WHAT IS CLAIMED IS:

1. A compound comprising a polyamide backbone bearing a plurality of ligands that are individually bound to aza nitrogen atoms located within said backbone, at least one of said ligands being a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group.

2. The compound of claim 1 wherein said aza nitrogen atoms are separated from one another in said backbone by from 4 to 6 intervening atoms.

3. A compound having the formula:

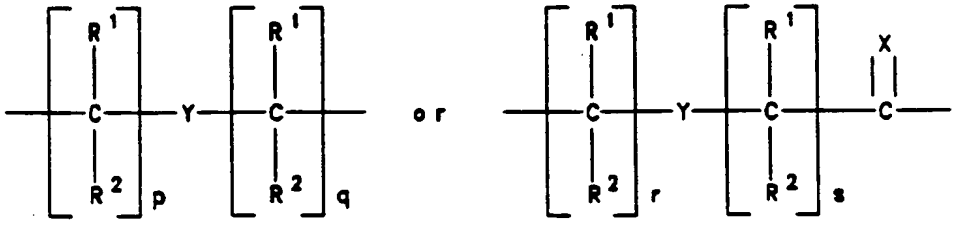


wherein:

n is at least 2,

each of L^1-L^n is independently selected from the group consisting of hydrogen, hydroxy, (C_1-C_4)alkanoyl, naturally occurring nucleobases, non-naturally occurring nucleobases, aromatic moieties, DNA intercalators, nucleobase-binding groups, heterocyclic moieties, and reporter ligands, at least one of L^1-L^n being a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

each of A^1-A^n is a single bond, a methylene group or a group of formula:



where:

X is O, S, Se, NR^3, CH_2 or $C(CH_3)_2$;

Y is a single bond, O, S or NR^4;

each of p and q is zero or an integer from 1 to 5, the sum p+q being not more than 10;

each of r and s is zero or an integer from 1 to 5, the sum r+s being not more than 10;

each R^1 and R^2 is independently selected from the group consisting of hydrogen, (C_1-C_4)alkyl which may be hydroxy- or alkoxy- or alkylthio-substituted, hydroxy, alkoxy, alkylthio, amino and halogen; and

each R^3 and R^4 is independently selected from the group consisting of hydrogen, (C_1-C_4)alkyl, hydroxy- or alkoxy- or alkylthio-substituted (C_1-C_4)alkyl, hydroxy, alkoxy, alkylthio and amino;

each of B^1-B^n is N or R^3N^+, where R^3 is as defined above;

each of C^1-C^n is CR^6R^7, CHR^6CHR^7 or $CR^6R^7CH_2$, where R^6 is hydrogen and R^7 is selected from the group consisting of the side chains of naturally occurring alpha amino acids, or R^6 and R^7 are independently selected from the group consisting of hydrogen, (C_2-C_6)alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C_1-C_6)alkoxy, (C_1-C_6)alkylthio, NR^3R^4 and SR^5, where R^3 and R^4 are as defined above, and R^5 is hydrogen, (C_1-C_6)alkyl, hydroxy-, alkoxy-, or alkylthio- substituted (C_1-C_6)alkyl, or R^6 and R^7 taken together complete an alicyclic or heterocyclic system;

each of D^1-D^n is CR^6R^7, $CH_2CR^6R^7$ or CHR^6CHR^7, where R^6 and R^7 are as defined above;

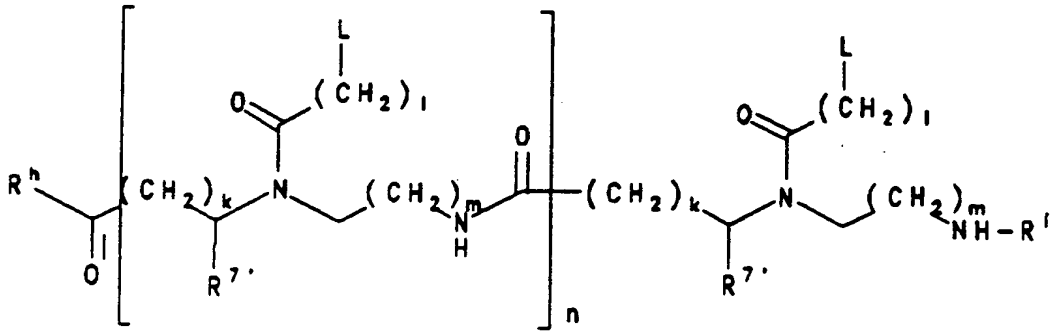
each of G^1-G^{n-1} is $-NR^3CO-$, $-NR^3CS-$, $-NR^3SO-$ or $-NR^3SO_2-$, in either orientation, where R^3 is as defined above;

Q is $-CO_2H$, $-CONR'R''$, $-SO_3H$ or $-SO_2NR'R''$ or an activated derivative of $-CO_2H$ or $-SO_3H$; and

I is $-NHR'''R''''$ or $-NR'''C(O)R''''$, where R', R", R''' and R'''' are independently selected from the group consisting of hydrogen, alkyl, amin prot cting groups, reporter ligands, intercalators, chelators, peptides,

proteins, carbohydrates, lipids, steroids, oligonucleotides and soluble and non-soluble polymers.

4. The compound of claim 3 having the formula:



wherein:

each L is independently selected from the group consisting of hydrogen, phenyl, heterocyclic moieties, naturally occurring nucleobases, and non-naturally occurring nucleobases;

each $R^{7'}$ is independently selected from the group consisting of hydrogen and the side chains of naturally occurring alpha amino acids;

n is an integer from 1 to 60,

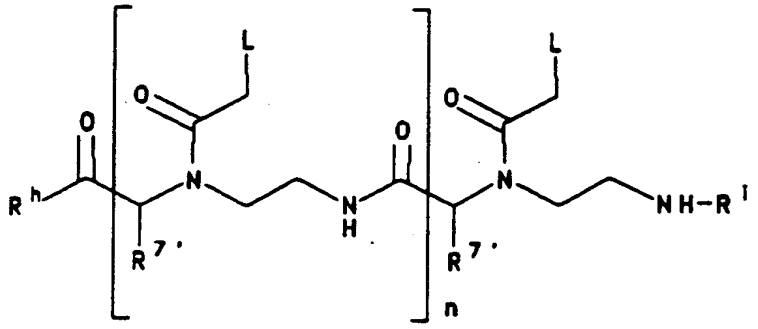
each k and m is, independently, zero or 1;

each l is zero or an integer from 1 to 5;

R^h is OH, NH_2 or -NHLysNH$_2$; and

R^i is H or $COCH_3$.

5. The compound of claim 4 having formula:

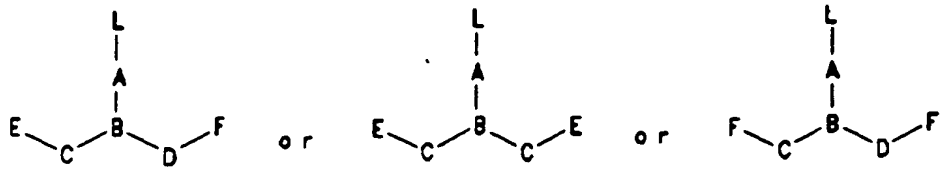


ach L is ind pendently selected from the group consisting of the nucleobases thymine, adenine, cytosine, guanine, and uracil;

each $R^{7'}$ is hydrogen; and

n is an integer from 1 to 30.

6. A compound having one of the following formulas:



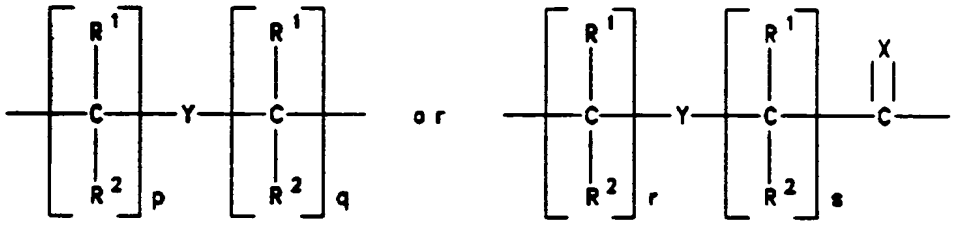
wherein:

L is selected from the group consisting of hydrogen, hydroxy, (C_1-C_4)alkanoyl, naturally occurring nucleobases, non-naturally occurring nucleobases, aromatic moieties, DNA intercalators, nucleobase-binding groups, and heterocyclic moieties, reporter ligands, wherein:

at least one of L^1-L^n is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group; and

amino groups are, optionally, protected by amino protecting groups;

A is a single bond or a group of the formula:



where:

X is O, S, Se, NR^3, CH_2 or $C(CH_3)_2$;

Y is a single bond, O, S or NR^4;

each of p and q is zer r an integer from 1 to 5, the sum p+q b ing not more than 10;

each of r and s is zero or an integer from 1 to 5, the sum r+s being not more than 10;

each R^1 and R^2 is independently selected from the group consisting of hydrogen, (C_1-C_4)alkyl, hydroxy- or alkoxy- or alkylthio-substituted (C_1-C_4)alkyl, hydroxy, alkoxy, alkylthio, amino and halogen; and

each R^3 and R^4 is independently selected from the group consisting of hydrogen, (C_1-C_4)alkyl, hydroxy- or alkoxy- or alkylthio-substituted (C_1-C_4)alkyl, hydroxy, alkoxy, alkylthio and amino;

B is N or R^3N^+, where R^3 is as defined above;

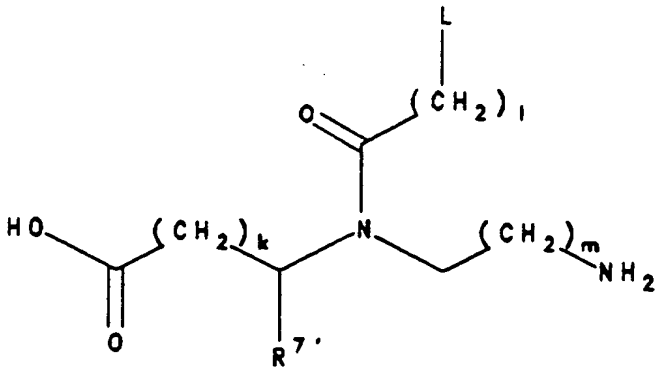
each C is CR^6R^7, CHR^6CHR^7 or $CR^6R^7CH_2$, where R^6 is hydrogen and R^7 is selected from the group consisting of the side chains of naturally occurring alpha amino acids, or R^6 and R^7 are independently selected from the group consisting of hydrogen, (C_2-C_6)alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C_1-C_6)alkoxy, (C_1-C_6)alkylthio, NR^3R^4 and SR^5, where R^3 and R^4 are as defined above, and R^5 is hydrogen or (C_1-C_6)alkyl, hydroxy-, alkoxy-, or alkylthio- substituted (C_1-C_6)alkyl, or R^6 and R^7 taken together complete an alicyclic or heterocyclic system;

each D is CR^6R^7, $CH_2CR^6R^7$ or CHR^6CHR^7, where R^6 and R^7 are as defined above;

each E is COOH, CSOH, SOOH, SO_2OH or an activated or protected derivative thereof; and

each F is NHR^3 or $NPgR^3$, where R^3 is as defined above, and Pg is an amino protecting group.

7. The compound of claim 6 having the formula:



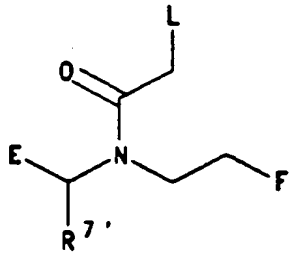
wherein:

each L is independently selected from the group consisting of hydrogen, phenyl, heterocyclic moieties, naturally occurring nucleobases, and non-naturally occurring nucleobases;

each $R^{7'}$ is independently selected from the group consisting of hydrogen and the side chains of naturally occurring alpha amino acids; and

each k, l, and m is, independently, zero or an integer from 1 to 5.

8. The compound of claim 7 having formula:



wherein:

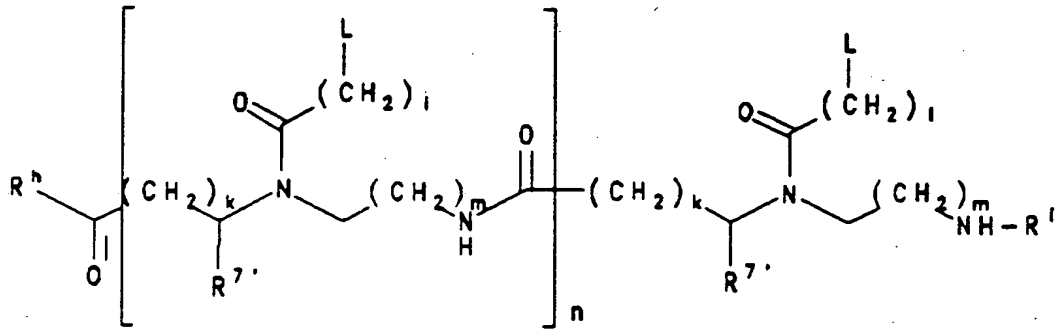
L is selected from the group consisting of the nucleobases thymine, adenine, cytosine, guanine, uracil, 5-methylcytosine, 6-thioguanine and 5-bromouracil, and prot cted derivatives th r of;

$R^{7'}$ is hydrogen;

E is COOH or an activated or protected derivative thereof; and

F is NH_2 or NHPg, where Pg is an amino protecting group.

9. A compound having the formula:



wherein:

each L is independently selected from the group consisting of hydrogen, phenyl, heterocyclic moieties, naturally occurring nucleobases, and non-naturally occurring nucleobases;

each $R^{7'}$ is independently selected from the group consisting of hydrogen and the side chains of naturally occurring alpha amino acids;

n is an integer from 1 to 60,

each k, l, and m is, independently, zero or an integer from 1 to 5;

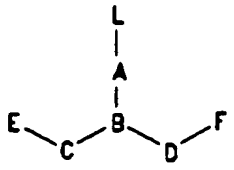
R^h is OH, NH_2 or -NHLysNH$_2$; and

R^i is H or $COCH_3$.

10. A process for preparing a compound according to claim 1, comprising the steps of:

A) providing a polymer substrate, said polymer being functionalized with a chemical group capable of forming an anchoring linkage with an amino acid;

B) coupling said polymer with a first amino acid through said anchoring linkage, said first amino acid having formula (IV):

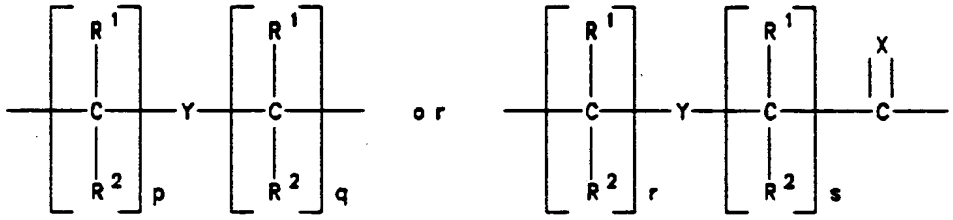


(IV)

wherein:

L is selected from the group consisting of naturally occurring nucleobases, non-naturally occurring nucleobases, aromatic moieties, DNA intercalators, nucleobase-binding groups, heterocyclic moieties, and reporter ligands, wherein amino groups are, optionally, protected by amino protecting groups;

A is a single bond or a group of the formula:



where:

X is O, S, Se, NR^3, CH_2 or $C(CH_3)_2$;

Y is a single bond, O, S or NR^4;

p and q are zero or integers from 1 to 5, the sum p+q being not more than 10;

r and s are zero or integers from 1 to 5, the sum r+s being not more than 10;

R^1 and R^2 are independently selected from the group consisting of hydrogen, (C_1-C_4)alkyl, hydroxy- or alkoxy- or alkylthio-substituted (C_1-C_4)alkyl, hydroxy, alkoxy, alkylthio, amino and halogen; and

R^3 and R^4 are independently selected from the group consisting of hydrogen, (C_1-C_4)alkyl, hydroxy- or alkoxy- or alkylthio-substituted (C_1-C_4)alkyl, hydroxy, alk xy, alkylthio and amino;

B is N or R^3N^+, wh re R^3 is as defined above;

C is CR^6R^7, CHR^6CHR^7 or $CR^6R^7CH_2$, where R^6 is hydrog n and R^7 is select d from th group consisting

of the side chains of naturally occurring alpha amino acids, or R^6 and R^7 are independently selected from the group consisting of hydrogen, (C_2-C_6)alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C_1-C_6)alkoxy, (C_1-C_6)alkylthio, NR^3R^4 and SR^5, where R^3 and R^4 are as defined above, and R^5 is hydrogen or (C_1-C_6)alkyl, hydroxy-, alkoxy-, or alkylthio- substituted (C_1-C_6)alkyl, or R^6 and R^7 taken together complete an alicyclic or heterocyclic system;

D is CR^6R^7, $CH_2CR^6R^7$ or CHR^6CHR^7, where R^6 and R^7 are as defined above;

E is COOH or an activated or protected derivative thereof; and

F is $NPgR^3$ where R^3 is as defined above and Pg is an amino protecting group;

C) removing said amino protecting group from said coupled first amino acid to generate a free amino group; and

D) reacting said free amino group with a second amino acid having formula (IV) to form a peptide chain.

11. The process of claim 10 further comprising the steps of:

E) removing said amino protecting group from said second amino acid to generate a terminal free amino group on said peptide chain; and

F) reacting said free amino group on said peptide chain with a further amino acid having formula (IV) to lengthen said peptide chain.

12. The process of claim 11 wherein steps E and F are performed a plurality of times.

13. The process of claim 11 further comprising removing at least one protecting group remaining on the amin acid moieties of the peptid chain.

14. The process of claim 10 further comprising cleaving said anchoring linkage without substantially degrading said peptide chain.

15. The process of claim 10 wherein the polymer substrate contains polystyrene, polyacrylamide, silica, a composite material, cotton, or a derivative thereof.

16. The process of claim 10 wherein the chemical group capable of forming said anchoring linkage is chloro-, bromo- and iodo-substituted alkyl, amino-substituted alkyl, amino and aryl-substituted alkyl, amino- and alkylaryl-substituted alkyl, hydroxy-substituted alkyl, or a derivative thereof having a spacer group that can be cleaved substantially without degradation of said polypeptide.

17. The process of claim 16 wherein chloro-substituted alkyl is chloromethyl, amino-substituted alkyl is aminomethyl, amino- and alkyl-substituted aryl is α-aminobenzyl, amino- and alkylaryl-substituted alkyl is selected from the group consisting of α-amino-3- and α-amino-4-methylbenzyl, and hydroxy-substituted alkyl is hydroxymethyl.

18. The process of claim 16 wherein:

the chemical group is derived from an amino-containing moiety selected from amino-substituted alkyl, amino- and aryl substituted alkyl, and amino- and alkylaryl-substituted alkyl; and

the chemical group includes a spacer group derived from the group consisting of 4-(haloalkyl)aryl-lower alkanoic acids, Boc-aminoacyl-4-(oxymethyl)aryl-lower alkanoic acids, N-Boc-p-acylbenzhydrylamines, N-Boc-4'-(lower alkyl)-p-acylbenzhydrylamin s, N-Boc-4'-(lower alkoxy)-p-acylbenzhydrylamines, and 4-hydroxymethylphenoxy-lower alkanoic acids.

19. A process for sequence-specific recognition of a double-stranded polynucleotide, comprising contacting said polynucleotide with a compound that is different from natural RNA and that binds to one strand of the polynucleotide, thereby displacing the other strand.

20. The process of claim 19 wherein said compound is an oligomer comprising a homogenous or heterogenous backbone to which are linked naturally occurring nucleobases, non-naturally occurring nucleobases or other ligands that individually bind by hydrogen bonding to at least one natural nucleobase in said polynucleotide strand.

21. The process of claim 20 wherein said compound is the compound of claim 1.

22. The process of claim 20 wherein said compound is the compound of claim 4.

23. A process for modulating the expression of a gene in an organism, comprising administering to said organism a compound according to claim 1 that specifically binds to DNA or RNA deriving from said gene.

24. The process of claim 23 wherein said compound is the compound of claim 1.

25. The process of claim 23 wherein said compound is the compound of claim 4.

26. The process of claim 23 wherein said modulation includes inhibiting transcription of said gene.

27. The process of claim 23 wherein said modulation includes inhibiting replication of said gene.

27A. A process for modulating the activity of a double stranded polynucleotide, comprising contacting said polynucleotide with a compound that is different from natural RNA and that binds to one strand ofe polynucleotide, thereby displacing the other strand

28. A process for treating conditions associated with undesired protein production in an organism, comprising contacting said organism with an effective amount of a compound according to claim 1 that specifically binds with DNA or RNA deriving from a gene controlling said protein production.

29. The process of claim 28 wherein said compound is the compound of claim 1.

30. The process of claim 28 wherein said compound is the compound of claim 4.

31. A process for inducing degradation of DNA or RNA in cells of an organism, comprising administering to said organism a compound according to claim 1 that specifically binds to said DNA or RNA.

32. A process for killing cells or virus, comprising contacting said cells or virus with a compound according to claim 1 that specifically binds to a portion of the genome of said cells or virus.

33. A pharmaceutical composition comprising a compound according to claim 1 and at least one pharmaceutically effective carrier, binder, thickener, diluent, buffer, preservative, or surface active agent.